ABSTRACTS FROM ASTRONOMICAL PUBLICATIONS.

In accordance with a recent arrangement the members of the scientific staff of the Lick Observatory hold meetings once per week, as an observatory duty, to report upon and discuss the more important articles appearing in the journals of astronomy, the important new books on astronomical subjects, or subjects of current and special interest in the observatory's work. It has been suggested that abstracts of the reports would be of interest to the readers of these Publications, and the Publication Committee has acted favorably upon the suggestions.

It is intended to preserve the qualities of abstracts as far as possible, and to restrict published criticisms, favorable or unfavorable, to a minimum.

MEASURES OF PROPER-MOTION STARS MADE WITH THE 40-INCH REFRACTOR OF THE YERKES OBSERVATORY IN THE YEARS 1907 TO 1912 BY S. W. BURNHAM.[1]

Professor BURNHAM's enthusiasm in the study of relative stellar motions is untiring. For many years he has been known as the foremost living double-star observer and the one who has done more than any other since STRUVE's time to further this branch of astronomy. And now, at an age when most observers retire from actual work, he gives us a most important contribution to the study of the proper motions of stars, including no less than 9,500 measures made with the micrometer of the great 40-inch refractor.

The working program was made up principally of stars selected from the *General Catalogue of Double Stars*, "for reasons which will generally be apparent from the notes and observations cited in that work. By far the greater number of stars given in the *General Catalogue* as having proper motions are not included here, because the observations there cited are of recent date and further measures are not needed at this time." The measures of this list from Part II of the present volume, which may therefore be regarded, as the author says, as in a sense supplementary to the *General Catalogue*. Part I contains measures of "all other stars for which prior observations with the micrometer have been made." This is a much shorter list than the other.

[1] Washington, D. C., 1913. Published by the Carnegie Institution of Washington. 4 to, paper, pp. iv + 311.

The object of the measures is, as appears from the title, to accumulate data for more accurate determinations of proper motions of the stars. It is clear to any one who has studied the matter that such motions can be determined far more accurately from micrometer measures than from meridian observations, provided (1) that the comparison stars have no sensible proper motions, and, (2) that the time interval covered by the series of measures is of the same order as that covered by the meridian measures. The second condition can be met in due time, and BURNHAM'S work, as well as that of others, has shown that the first is realized if the comparison stars are independent and faint. To quote from the brief introduction:

"For many years I have been hunting for a faint star with some certain proper motion, but so far without success; and the observations of others to this time give only negative results. It goes without saying that every star in the heavens, down to the limit of the largest aperture, must have some proper motion as well as parallax; and it is equally obvious that the one is as negligible as the other in all observations of relative positions with any astronomical instrument now in use."

This remark, of course, does not apply to the faint companions of brighter stars which share in the motion of the latter. Ultimately, we shall be able to detect the minute proper motions of the fainter stars in general by the continuation of just such measures as those in this volume, and by the comparison of photographs taken at suitable intervals.

The measures are arranged in the convenient form which we have come to expect in BURNHAM'S volumes, and mechanically, the book leaves nothing to be desired. R. G. AITKEN.

July, 1913.

THE ASTRONOMICAL UNIT OF DISTANCE.

Distances in the solar system are usually expressed in terms of the mean distances of the Earth from the Sun. This mean distance is called the astronomical unit. Stellar distances, however, are so immense that this unit is of little use. The unit called the light-year is then employed to indicate, with however much or little comprehension it may induce, the distance which light travels in one year through stellar space.

In discussing distances of nebulæ, Professor VERY, of Westwood, Massachusetts, proposes as a unit the distance of the *Andromeda* nebula and the name *andromede*.[1] This unit would be of the order of one thousand light-years.

In discussions of the distribution of stars in space, of star streams and of stellar motions, there has recently come into use as a unit of distance that corresponding to a parallax of one second of arc. This distance is about three light-years. Dr. DYSON, Astronomer Royal of England, says,[2] "there is need for a name for this unit of distance. CHARLIER, of Lund, has suggested *siriometer*. Professor TURNER, of Oxford, suggests *macron* or *parsec*, which may taken as an abreviated form of the expression *a distance corresponding to a parallax of one second*. If, however, violence to the Greek language can be overlooked, the word *astron* might be adopted." Again, SEELIGER has called the distance corresponding to 0".2 of arc of parallax *siriusweite*.

Of all these suggestions the designation *astron*, or perhaps *astromeier*, would seem very appropriate.

G. F. PADDOCK.

THE RELATION OF STELLAR VELOCITIES AND MASSES.

In a recent number of the *Astronomische Nachrichten*[3] we find a discussion by H. SEELIGER upon the dependence of the velocities of the stars upon their masses. The idea of "cosmic dust cloud" has many times been applied to the stellar system. Furthermore, the conditions in this system of discrete masses have been taken to resemble those in a gas. But caution must be used in applying the laws of the kinetic theory of gas. There are certain facts which point to a far-reaching analogy between a mass of gas and the star system. First, there are numerous cases of large velocity which cannot be explained as a consequence of the gravitation of the stellar system as a whole. NEWCOMB suggested that these rapid stars may have entered from outside the stellar system. But this is not very likely nor necessary. KELVIN suggested that these large velocities might be due to near approach of bodies to others of

[1] *Popular Science Monthly*, **82**, 294.
[2] *Monthly Notices*, **73**, 342.
[3] *Astronomische Nachrichten, Band*, **194**, 274.

strong attraction. A second fact which is shown by Dr. CAMPBELL'S discussion of the radial velocities of the stars is that mean radial velocities of the several spectral classes of stars increases from B to M. It is probable that early-type stars are the more massive. From all these points it may be construed that mass and velocity are inversely related. In the kinetic theory of gases the velocities of the molecules are inversely as the square roots of their masses. If this law be applicable to the stellar system the observed facts may be accounted for to a certain extent, but not satisfactorily.

SEELIGER has made other assumptions which have no connection with the kinetic theory of gases and by an extensive mathematical discussion obtains the result that the smaller masses must have the larger velocities. It is assumed that the masses originated by the collection of small unit masses, which possessed any values of velocity whatever. The treatment is then based upon the probabilities of the velocities and the conclusion drawn that the velocities are less as the masses are greater. The result explains observed phenomena only in a qualitative way. The full explanation of stellar velocities is yet to be found. G. F. PADDOCK.

ON THE OCCURRENCE OF THE ENHANCED LINES OF TITANIUM IN ELECTRIC-FURNACE SPECTRUM, BY A. S. KING.[1]

In the course of an investigation of the variations of the spectrum of titanium given by different temperatures of the electric furnace, special effort was made to obtain the enhanced lines and fix their place, if possible, on a temperature scale. Upon pushing the temperature of the furnace beyond 2600° C by the use of tubes with thinner walls, these walls burned through, with the formation of an arc, furnishing in the process conditions under which the enhanced lines appeared with a relative intensity usually seen in the condenser spark, although the potential at no time appeared to rise above 33 volts. The results of these experiments are summarized as follows:—

[1] *Astrophysical Journal*, **37**, 119, 1913, (March).

1. The enhanced lines of titanium appear in the regular furnace spectrum for temperatures probably somewhat higher than 2600° C, but are very faint compared to the arc lines.

2. At still higher temperatures, while furnace conditions still exist, there are indications of a slight increase in the relative strength of the enhanced lines.

3. When the furnace tube burns through with the formation of a low-voltage arc, the consumption of electrical energy at the point being very large, the enhanced lines of titanium and the spark line λ 4267 of carbon appear with an intensity usually attainable only in powerful sparks.

4. By photographing with the slit across the image of the tube's interior, the relative strength of the enhanced lines is seen to be much greater in the center of the tube than near the wall, this effect being very pronounced in the case of the carbon spark line.

5. The vapor in the center of the broken tube shows a tendency to give a line farther to the red than that near the wall, this being shown in the increasing dissymetry of the lines from the end toward the middle. The effect is in harmony with the action of the condensed spark. E. PHŒBE WATERMAN.

May, 1913.

ASTRONOMY, BY GEORGE F. CHAMBERS.[1]

The author's motive in writing this book may be gathered from the following statements quoted from his preface: "This volume is not a formal treatise on astronomy, nor is it a mere educational text-book. . . . There is nothing profound or inconveniently deep in it, but it just gives a popular outline of leading facts. . . . My idea has been to direct the reader's attention to what may be called every-day topics. . . ."

The author has had a wide experience, both as a writer and as a lecturer, on astronomical subjects and has naturally produced a readable book, which gains a further interest from the unusually large number of illustrations. These are of varying degrees of excellence and some are very good indeed. But the eight colored plates will convey, for the most part, a wrong impression of the colors of the objects as actually seen

[1] D. Van Nostrand Co., New York, 1913. $1.50.

through the telescope. The colors are made far too brilliant and too definite in their contrast to represent the reality. This applies particularly to the plates of colored double stars, and in only less degree to those of the planets.

There are many statements in the book to which exception might be taken if it claimed to be in any sense a treatise on the subject, and only the briefest references are made in it to some of the most significant advances in the science during the past two decades. Occasionally this incompleteness may give an incorrect idea of the actual state of present knowledge, but there are few passages that are in themselves misleading.

It is particularly pleasant to find the book well printed on good paper and quite free from obvious typographical errors. Among the few that were noticed is the statement in the preface locating the Yerkes Observatory at Williams*town* instead of at Williams Bay. R. G. AITKEN.

June, 1913.

LEHRBUCH DER SPHÄRISCHEN ASTRONOMIE, VON DR. L. DE BALL.[1]

This addition to the list of compendia of spherical astronomy is a finely printed quarto in the best style of the German book-maker's art, and is intended to serve as a manual for the student as well as a handbook for the working astronomer. The astronomer will find in it a valuable reference book, wherein are brought together and given with very full and thorough treatment the majority of the subjects properly falling under the head of spherical astronomy, some of which have hitherto not been easily accessible.

Certain fields are treated with a fullness and rigor which seems almost superfluous as far as the needs of the working astronomer are concerned; 64 of the 387 pages are devoted to a discussion of the rotation of the Earth; with so much space available for the treatment of this phase of the subject, it would have seemed advisable to include something on latitude variation, and to have given more space to the HORREBOW-TALCOTT method. So, also, the treatment of refraction from

[1] Wilhelm Engelmann, Leipzig, 1912. 4 to, pp. xv + 387. $5.00.

its theoretical standpoint seems unduly full for a reference book of this sort, as 55 pages are devoted to the subject, while nothing at all is given in the important field of the spherical astronomy of the photographic plate.

Aside from these omissions, it will be found an unusually full and comprehensive reference book on the subject, with numerous improvements and simplifications in stating well-known methods, and not a little matter not easily accessible, as, for instance, the methods of determining the parallax of star-streams, and the chapter on astrographic determinations of position, with special reference to selenographic co-ordinates. A full and clear treatment is given of occultations, and of solar and lunar eclipses, while at the beginning of the book are collected the usual formulæ for interpolation, mechanical quadrature, least square, and spherical trigonometry. H. D. C.